

C - Anatomy C - Rickards Invitational Div. C - 12-05-2020



2021 Rickards Anatomy C Exam

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Hi everyone! Welcome to the **Rickards Anatomy C exam!** I just have a few quick tips and information/instructions for you before you get started.

Information & Instructions:

- The topics on this exam include **Nationals** topics.
- For fill-in-the-blank questions, capitalization does not affect your score, but incorrect spelling **does affect your score**. Most fill-in-the-blank questions will prompt you to avoid misunderstanding.
- Some diagrams are labeled through fill in the blank and others through short answer. When labeling diagrams through short answer, make sure to clearly indicate which answer corresponds to which label on the diagram. Otherwise, the graders cannot award you points.
- You can contact me for questions through email: ambermath99@gmail.com or through Discord [@Silverleaf1#5370](#).

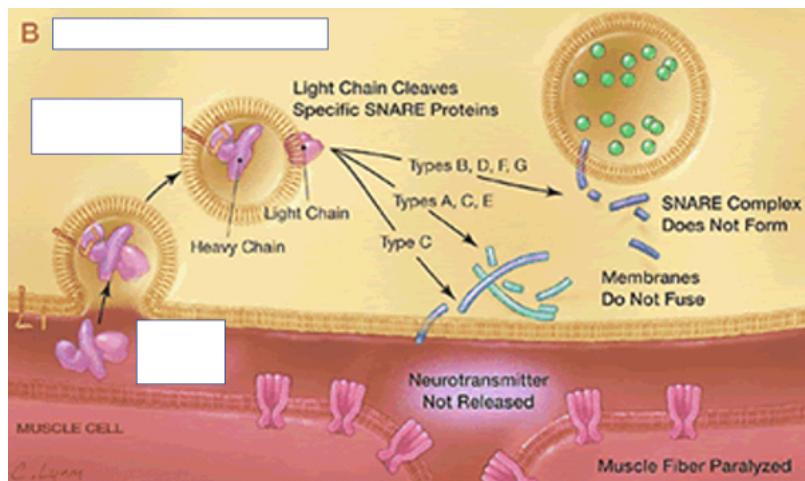
One more general tip: this test is pretty long, and it's meant to be difficult. Don't worry about leaving questions blank or skipping sections - it's a good idea to snatch the easy points (there are many!) and attempt the hard points later. Most importantly, this test is meant to be fun, so have fun! :3

1. (1.00 pts) Curare is a competitive inhibitor of acetylcholine at neuromuscular junctions. Curare:

(Mark ALL correct answers)

- A) Can cause flaccid paralysis
 B) Can cause spastic paralysis
 C) Decreases the amount of acetylcholine released from the motor neuron
 D) Binds acetylcholine and prevents it from binding to receptors

2. (1.00 pts)



This diagram is demonstrating the action of which of the following?

- A) Botulinum toxin
 B) Curare
 C) Atropine
 D) Neostigmine
 E) Streptomycin

3. (3.00 pts)

DHP receptors are L-type Ca²⁺ channels located in the T-tubule that act as voltage sensors. Which of the following are ways in which DHP primarily contributes to muscle contraction?

(Mark ALL correct answers)

- A) Ca²⁺ influx from DHP binds to RyR, creating a conformational change that allows Ca²⁺ to leave the sarcoplasmic reticulum
 B) Ca²⁺ influx from DHP directly causes skeletal muscle contraction
 C) DHP is mechanically coupled to RyR, so when DHP opens, RyR opens too and releases Ca²⁺
 D) The opening of DHP channels activates myosin light chain kinase and stimulates contraction
 E) Entry of Ca²⁺ through DHP increases the number of acetylcholine receptors in the sarcolemma

4. (3.00 pts)

Acetylcholine binds to [blank] acetylcholine receptors and causes an influx of [write out the full name of the element] ions, resulting in an action potential that releases calcium ions from the [organelle].

nicotinic

sodium

sarcoplasmic reticulum

5. (2.00 pts) Justin has an extremely rare genetic disorder that causes him to lack T-tubules! Which of the following symptoms do you think Justin would have?

(Mark ALL correct answers)

- A) Seizures
 B) Muscle weakness
 C) Slow reaction times
 D) Diarrhea
 E) Cold extremities

6. (3.00 pts)

An evil scientist that goes by the name Dr. Chung designs a toxin that inhibits the action of P-type Ca²⁺ ATPases in muscle cells. Which of the following would you expect to occur in someone exposed to this toxin?

(Mark ALL correct answers)

- A) Spastic paralysis
 B) Flaccid paralysis
 C) Increased Ca²⁺ levels in the cytoplasm
 D) Increased Cl⁻ levels in the cytoplasm
 E) Increased sarcomere length

7. (1.50 pts)

The I band [shortens or lengthens] during contraction, the A band [shortens or lengthens] during contraction, and the H zone [shortens or lengthens] during contraction.

shortens

lengthens

shortens

8. (2.00 pts) Which of the following are located in the I band?

(Mark ALL correct answers)

- A) Myosin
- B) Actin
- C) Nebulin
- D) Titin
- E) α -actinin
- F) Myomesin

9. (2.00 pts)

Rebecca is really short and Luke is really tall. Rebecca thinks that the shorter the sarcomere, the stronger the force of contraction, while Luke thinks that the longer the sarcomere, the stronger the force of contraction. Explain why both of them are wrong.

Expected Answer: Luke is wrong because if a sarcomere is too long, the zone of overlap will be too small to allow for cross bridges to form (1). Rebecca is wrong because if a sarcomere is too short, the thick filaments are pushed against the Z disc and the thin filaments may overlap at the H zone, interfering with the ability of the muscle fiber to contract (1)

10. (1.00 pts)

Ms. Onagires is teaching a physics class and is explaining the concept of force by picking up a heavy Science Olympiad binder. What kind of contraction is the agonist of arm flexion undergoing?

- A) Isometric
- B) Concentric
- C) Eccentric

11. (1.00 pts) Ms. Onagires lifted the Science Olympiad binder up 4 feet above the ground and held it there. What kind of contractions is the agonist of arm flexion undergoing?

- A) Isometric
- B) Concentric
- C) Eccentric

12. (2.00 pts)

Now Ms. Onagires is teaching about levers! One of her favorite students, Anqi, refuses to learn about levers unless Ms. Onagires relates it to anatomy. Given the three actions, pick the choice that correctly classifies the lever system.

- A: Neck extension
- B: Elbow flexion
- C: Plantar flexion

- A) A: I
B: II
C: III
- B) A: I

- B: III
 C: II
 C) A: II
 B: I
 C: III
 D) A: II
 B: III
 C: I
 E) A: III
 B: I
 C: II
 F) A: III
 B: II
 C: I

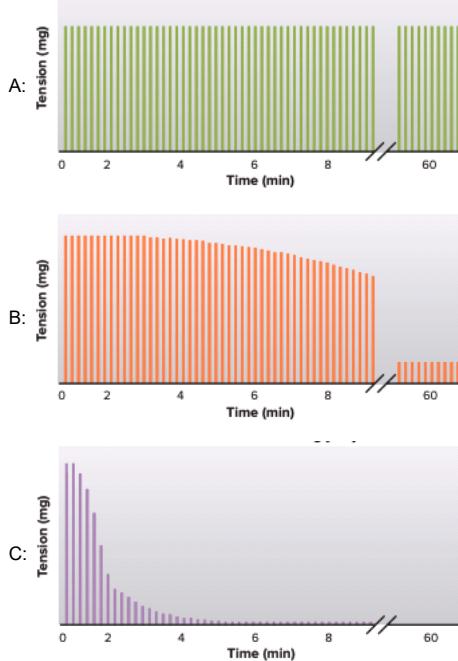
13. (1.00 pts) Type I and Type II fibers can be changed into each other.

- True False

14. (1.00 pts) Type I and Type II muscle fibers differ in the forms of myosin they contain.

- True False

15. (2.00 pts)



Which answer choice correctly labels the three graphs?

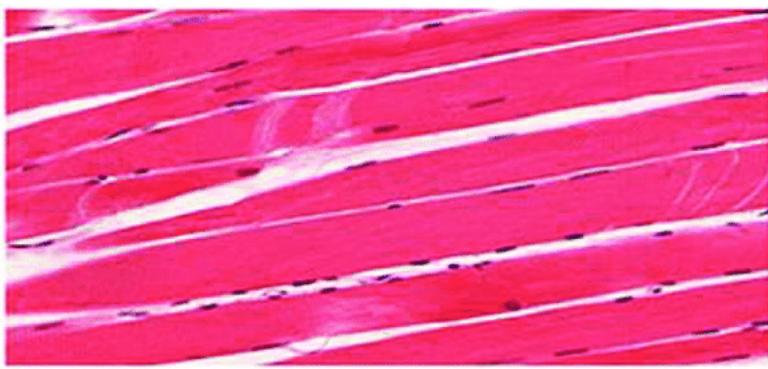
- A) A: Type IIA
 B: Type IIX

- C: Type I
 B) A: Type I
B: Type IIX
C: Type IIA
 C) A: Type IIX
B: Type IIA
C: Type I
 D) A: Type IIX
B: Type I
C: Type IIB
 E) A: Type I
B: Type IA
C: Type IIX
 F) A: Type IIA
B: Type I
C: Type IIX

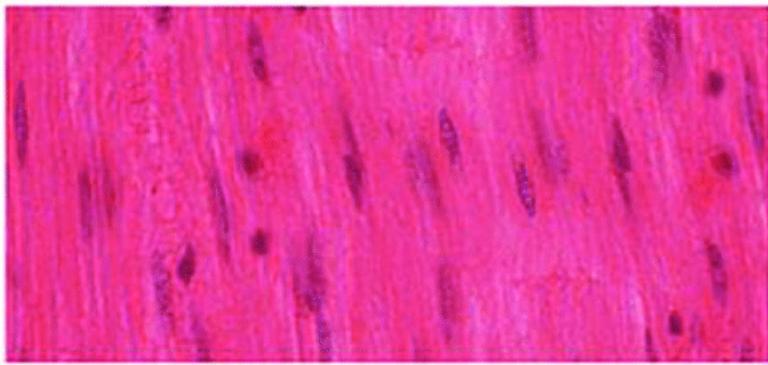
16. (1.00 pts) Type I muscle fibers mainly rely on creatine phosphate and glycogen.

- True False

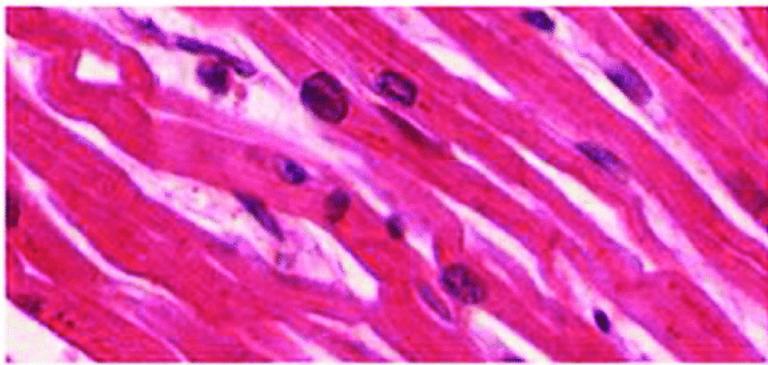
17. (2.00 pts) Refer to the following histologies:



(a)



(b)



(c)

Which of the above tissues has T-tubules?

(Mark **ALL** correct answers)

- A) A
- B) B
- C) C

18. (1.00 pts) Which of the following tissues is involuntary?

(Mark **ALL** correct answers)

- A) A
- B) B

C) C

19. (2.00 pts) Smooth muscle:

(Mark ALL correct answers)

- A) Can repair itself
- B) Can react to stretching
- C) Has well-developed sarcoplasmic reticulum
- D) Is multinucleated
- E) Depends on extracellular calcium for contraction
- F) Uses latch bridges to maintain muscle tone

20. (1.00 pts) In smooth muscle, dense bodies are to [blank] as calmodulin is to [blank].

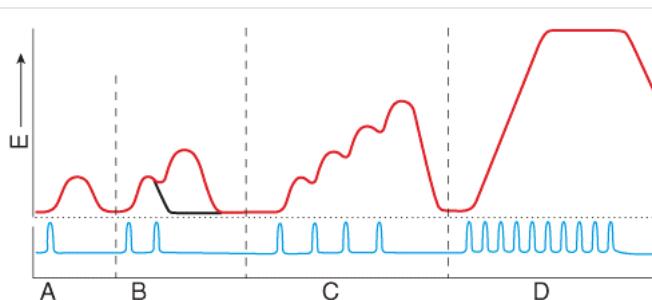
Z discs

troponin

21. (2.00 pts)

Single unit smooth muscle is innervated by a single autonomic neuron, meaning that not every cell is innervated by a neuron. However, single unit smooth muscle contracts as a unit meaning that every cell contracts from stimulus. Explain why this is possible.

Expected Answer: Single unit smooth muscle contains gap junctions (1) which allow ions to flow from cell to cell and propagate the action potential (1).



Label A, B, C, D, and E. E refers to the red line, not the blue line.

22. (0.50 pts) A:

twitch

23. (0.50 pts) B:

Wave summation

24. (0.50 pts) C (two words):

incomplete tetanus

25. (0.50 pts) D (two words):

complete tetanus

26. (0.50 pts) E (three words):

force of contraction

27. (1.00 pts) What is this type of graph called?

myogram

28. (1.00 pts) Complete tetanus is characterized by:

(Mark ALL correct answers)

- A) Stimulation immediately after the relaxation phase ends
- B) Heightened strength of contraction
- C) Elimination of the relaxation phase
- D) Decreased ATP usage
- E) Brief relaxation phases

29. (3.00 pts)

Golgi tendon organs [inhibit or stimulate] contraction and are innervated by [this type of] sensory neurons, which sense information about [tension, length, or velocity].

inhibit

Ia

length

30. (3.00 pts) Muscle spindles [inhibit or stimulate] contraction and are innervated by Type [blank] and Type [blank] neurons.

stimulate

Ia

II

31. (1.00 pts) Type Ia neurons encode information about velocity.

- True
- False

32. (1.00 pts) Type Ib neurons encode information about velocity but not weight.

- True
- False

33. (1.00 pts) Type II afferent neurons supply all intrafusal fibers in the muscle spindle.

True False

34. (1.00 pts) Which type of neuron restores the state of the intrafusal muscle fiber after contraction?

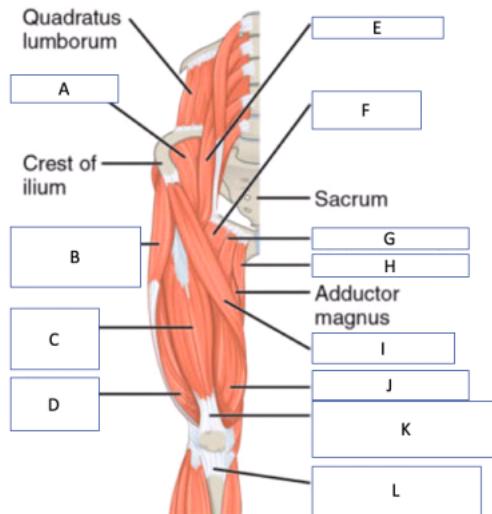
- A) Gamma
- B) Alpha
- C) Beta
- D) Omega
- E) Delta

35. (4.00 pts)

A balloon is placed in Ashley's hand and she is instructed to lift the balloon. Which would fire more action potentials in the triceps: Ia afferents or Ib afferents? Explain.

Expected Answer: Ia afferents would fire more action potentials because they sense stretch, and the triceps is being stretched (2). Because the load is light, the Golgi tendon organ is not significantly stretched and the Ib afferent doesn't fire as many action potentials (2).

36. (5.50 pts) Label the diagram:



Do NOT label F. Present your answer as:

A:

B:

C:

.

.

.

L:

Expected Answer: A: Iliacus B: Tensor fasciae latae C: Rectus femoris D: Vastus lateralis E: Psoas major G: Adductor longus H: Gracilis I: Sartorius J: Vastus medialis K: Quadriceps tendon L: Patellar ligament

37. (1.00 pts) The biceps brachii is to the biceps femoris as the triceps brachii is to the:

- A) Vastus medialis
- B) Rectus femoris
- C) Semitendinosus
- D) Gastrocnemius
- E) Brachialis

38. (1.00 pts) Tibialis anterior is to gastrocnemius as the deltoid is to:

- A) Biceps brachii
- B) Supraspinatus
- C) Teres major
- D) Trapezius
- E) Gracilis

39. (1.00 pts) Which muscle is the odd one out? Hint: Consider the shape of the muscles.

- A) Pectoralis major
- B) Temporalis
- C) Sartorius
- D) Adductor longus

40. (2.00 pts) Which muscles enable you to plantarflex?

(Mark **ALL** correct answers)

- A) Soleus
- B) Tibialis anterior
- C) Peroneus longus
- D) Fibularis brevis
- E) Sartorius

41. (1.00 pts) Claire is having trouble shrugging, and cannot windmill her arms. Which muscle did she most likely injure?

- A) Latissimus dorsi
- B) Trapezius
- C) Deltoid
- D) Coracobrachialis

- E) Supraspinatus

42. (3.00 pts)

Claire is remarkably talented at injuring herself. She is on the soccer team, and felt a sudden sharp pain at the front of the hip after kicking a ball. Within hours, the area was swollen and bruised. It was tender when pressed, and it hurt immensely when she tried to extend her knee or flex her hip. Which muscle was affected, and was this likely a strain or a sprain? You do not have to explain your answer.

Expected Answer: Rectus femoris (2); strain (1).

43. (2.00 pts) Recently, Karen, a 55-year old woman, has had unexpected skin rashes and on the face and eyelids, and around her nails. She is experiencing muscle weakness.



Based on this information, what would you diagnose Karen with?

Dermatomyositis

44. (1.00 pts) This disorder is most commonly caused by:

- A) Viral infection
- B) Bacterial infection
- C) Parasitic infection (multicellular organism)
- D) Autoimmunity
- E) Vitamin imbalance

45. (3.00 pts) Which of the following tests could you run to confirm her condition?

(Mark **ALL** correct answers)

- A) Blood test
- B) Electromyography
- C) Skin and muscle biopsy
- D) Spinal tap
- E) Urine samples

46. (3.00 pts) Which of the following are appropriate treatments for this disease?

(Mark **ALL** correct answers)

- A) Immunosuppressives
- B) Antibiotics
- C) Plasmapheresis
- D) Corticosteroids
- E) Acetylcholinesterase inhibitors

47. (1.00 pts)

Mourya was admitted to the ER today with difficulty swallowing, fever, and sweating. Yesterday, he was playing in the school playground with some of his friends and slipped in a pile of mud, getting it all over his new clothes. In a few hours, Mourya will experience muscle spasms. What will you diagnose Mourya with?

tetanus

48. (1.00 pts) What agent causes this disease?

Clostridium tetani

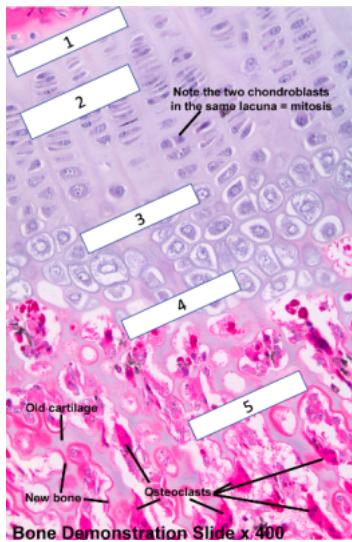
49. (3.00 pts) Describe how the agent you identified causes Mourya's muscle spasms.

Expected Answer: Destruction of glycine and GABA (2) releases motor neurons from inhibitory effects, causing excess action potentials and muscle spasms (1).

50. (1.00 pts) What is another name for the muscle spasms and arching that occurs in patients of this disease?

- A) Myotendinosis
- B) Sarcomyositis
- C) Opisthotonus
- D) Myospasmosis
- E) Spasmosis

51. (2.50 pts) Label the diagram:



Bone Demonstration Slide x 400

Present your answer as:

1:

2:

3:

4:

5:

Expected Answer: 1. Resting 2. Proliferation 3. Hypertrophy 4. Calcification 5. Ossification (.5 each)

52. (2.00 pts) The division of the cells in zone 2 is stimulated by which of the following hormones?

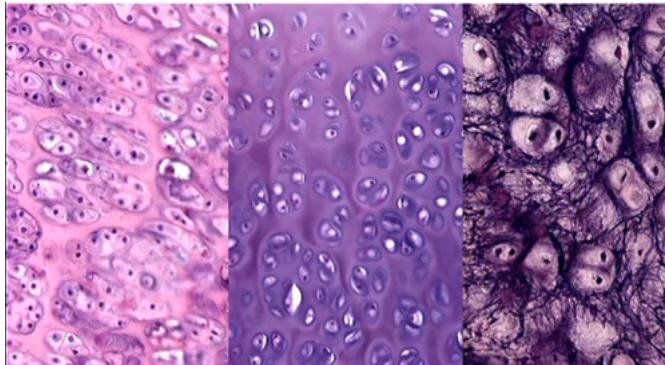
(Mark ALL correct answers)

- A) Growth hormone
- B) Prolactin
- C) IGF-1
- D) Cortisol
- E) Aldosterone

53. (1.00 pts) In which numbered zone do chondrocytes first begin to die in large numbers?

- A) 1
- B) 2
- C) 3
- D) 4
- E) 5

54. (2.00 pts)



A) Left: Fibrocartilage

Middle: Hyaline

Right: Elastic

B) Left: Hyaline

Middle: Fibrocartilage

Right: Elastic

C) Left: Fibrocartilage

Middle: Elastic

Right: Hyaline

D) Left: Elastic

Middle: Hyaline

Right: Fibrocartilage

E) Left: Elastic

Middle: Fibrocartilage

Right: Hyaline

F) Left: Hyaline

Middle: Elastic

Right: Fibrocartilage

55. (2.00 pts)

Parathyroid hormone increases [write the full name of the element] reabsorption in the kidneys, increases the activity of [this cell type] in the bone, and stimulates the formation of [the hormone] in the kidneys.

calcium

osteoclasts

calcitriol

56. (2.00 pts) Which of the following are DIRECT effects of PTH?

(Mark ALL correct answers)

A) Osteoblast proliferation

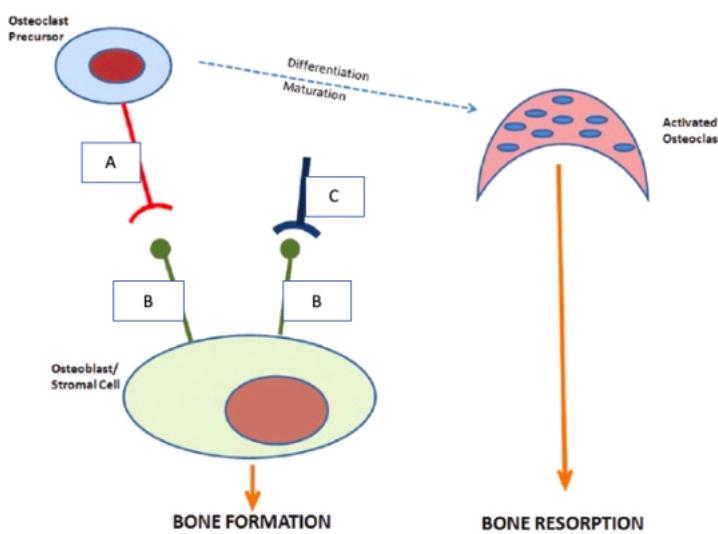
B) Increased Ca²⁺ reabsorption in the kidneys

C) Increased Ca²⁺ absorption in the small intestine

D) Osteoclast proliferation

E) Increased production of calcitriol

57. (3.00 pts) Label the following diagram of osteoclast activation:



First blank is A, second blank is B, and third blank is C.

58. (4.00 pts) Explain the role that parathyroid hormone plays in osteoclast activation. Include the following terms in your answer: RANKL, RANK, OPG, osteoclast precursor.

Expected Answer: Parathyroid hormone binds to its receptor on osteoblasts (1) and promotes expression of RANKL (1), inhibiting expression of OPG (1). Binding of RANKL to RANK stimulates osteoclast precursors to differentiate into active osteoclasts (1).

59. (5.00 pts)

Explain the process of calcitriol synthesis, starting with UV rays striking the skin. Include the following terms in your response: 7-dehydrocholesterol, 1,25-dihydroxycholecalciferol (calcitriol), 25-hydroxycholecalciferol (calcidiol), kidney, liver, vitamin D3.

Expected Answer: UV rays strike skin, 7-dehydrocholesterol is converted to vitamin D3 (1). D3 moves to the liver (1), where it is converted into calcidiol (25-hydroxycholecalciferol) (1). Calcidiol moves to the kidney (1), where it is converted to 1,25-dihydroxycholecalciferol (calcitriol) (1).

60. (2.00 pts) Select all statements that are true about calcitonin. Calcitonin:

(Mark **ALL** correct answers)

- A) Is synthesized in the thyroid gland by D cells
- B) Inhibits the action of osteoclasts
- C) Inhibits reabsorption of Na⁺ from the kidneys
- D) Inhibits reabsorption of P³⁻ from the kidneys
- E) Is stimulated by decreased blood Ca²⁺ level
- F) Is used to treat osteoporosis

61. (2.00 pts)

Luke is really tall and Rebecca is really short. Luke tries to console Rebecca by telling her that she's a female, and females reach their growth spurt later because estrogen is released later than testosterone. Is he right or wrong? Why?

Expected Answer: Luke is wrong (1); females reach their growth spurts sooner because estrogen is released earlier than testosterone (1).

62. (2.00 pts)

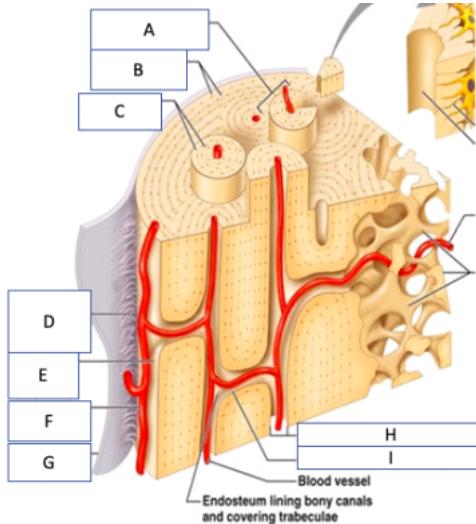
Luke is flexing his anatomy knowledge at Rebecca by spouting male-female differences in the skeletal system. Rebecca wants to flex her knowledge back. Which of the following are factually correct comebacks that Rebecca could use?

(Mark ALL correct answers)

- A) "My iliac bones are more flared than yours!"
- B) "My pelvis is less tilted forward than yours!"
- C) "I have a greater pubic arch angle than you!"
- D) "My sacral promontory is more pronounced than yours!"
- E) "I have a shorter distance between my ischial tuberosities than you!"

63. (1.00 pts) Matthew notices that the more he lifts weights, the more dense his bones seem to become. What law establishes this idea?

- A) Law of independent assortment
- B) Law of Bone Density
- C) Wolff's Law
- D) Law of Opposing Stresses
- E) Crick's Law
- F) Koch's Law

64. (4.50 pts) Label the following diagram:

Be as specific as possible.

Expected Answer: A: Osteon B: Interstitial lamellae C: Concentric lamellae D: Sharpey's fibers E: Compact bone/endosteum F: Periosteal blood vessel G: Periosteum H: Haversian canal I: Volkmann's canal (.5 each)

65. (1.00 pts) Most flat bones are created by endochondral ossification.

- True False

66. (2.00 pts) Place the following letters in chronological order.

- A: Chondrocytes die and leave cavities in bone
- B: Hyaline cartilage model is created
- C: Chondrocytes hypertrophy
- D: Chondrocytes secrete calcified matrix
- E: Perichondrium turns into periosteum
- F: Secondary ossification centers form
- G: Periosteal bud invasion
- H: Primary ossification centers form

- A) B, D, C, A, G, H, F, E
 B) B, C, D, A, G, E, H, F
 C) B, C, D, A, G, H, E, F
 D) B, C, G, D, A, H, E, F
 E) B, C, D, A, H, G, E, F

67. (1.00 pts) Which of the following bones are created from intramembranous ossification?

(Mark **ALL** correct answers)

- A) Clavicles
 B) Zygomatic bone
 C) Humerus
 D) Sphenoid
 E) Calcaneus
 F) Mandible

68. (2.00 pts) Place the following letters in chronological order:

- A: MSCs differentiate into osteoblasts
- B: Bone collar and red marrow form
- C: Mesenchymal stem cells cluster to form niduses
- D: Osteoblasts secrete matrix inward, trapping osteocytes
- E: Bone spicules fuse to form trabeculae
- F: Trabecular bone is formed

G: Periosteum is formed

H: Osteoblasts cluster around blood vessels and deposit bone matrix

I: Lamellar bone is formed

- A) B, C, D, G, A, H, E, F
- B) B, C, D, A, G, H, E, F
- C) C, B, D, A, G, H, E, F
- D) B, C, H, A, G, D, E, F
- E) B, C, D, A, E, F, G, H

69. (2.00 pts) Osteoclasts are located in [two words] in the endosteum and secrete [four words] to break down bone. Progenitors of osteoclasts are [blank].

osteoclastic crypts

tartrate resistant acid phosph

monocytes

70. (1.00 pts) Select the following statements that are true about osteocytes. Osteocytes:

(Mark ALL correct answers)

- A) Are osteoclasts trapped in bone matrix
- B) Secrete sclerostin, which inhibits osteoblasts and activates osteoclasts
- C) Communicate through canaliculi by extending dendrites
- D) Do not divide

71. (3.00 pts) Place the following letters in chronological order regarding bone healing:

- A: Granulation tissue develops by capillary invasion
- B: Osteoblasts deposit bony collar around fracture to unit broken pieces
- C: Fibrocartilaginous callus formation; precursor cells become chondroblasts and osteoblasts deposit spongy bone at edges
- D: Hematoma develops
- E: Bone remodeling
- F: Collagen and fibrocartilage is deposited

- A) D, A, C, F, B, E
- B) A, F, D, C, B, E
- C) D, A, F, E, B, C
- D) D, A, F, C, B, E
- E) D, A, F, B, C, E

72. (2.00 pts) Select the joints that classify as fibrous syndesmosis:

(Mark ALL correct answers)

- A) Sacroiliac
- B) First sternocostal joint
- C) Manubriosternal joint
- D) Distal tibiofibular joint
- E) Interosseous membrane in antebrachium

73. (1.00 pts) Symphyses are made of fibrocartilage

- True False

74. (1.00 pts) Synchondroses are stronger than symphyses because they are made of hyaline cartilage rather than fibrocartilage

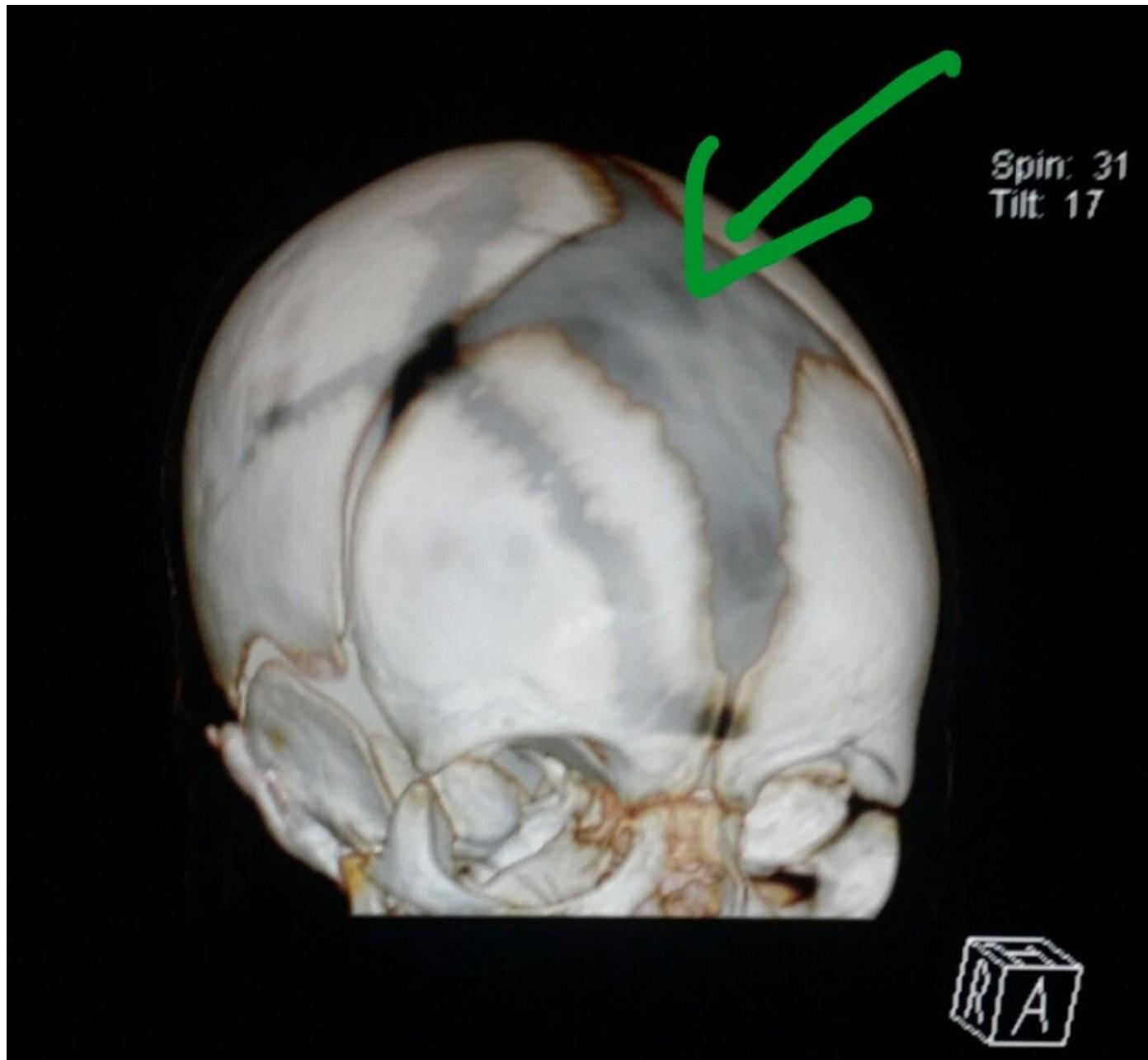
- True False

75. (1.00 pts) A synostosis is totally rigid and is created when two bones fuse.

- True False

76. (1.00 pts)

Refer to the following picture:



This picture is the skull of a(n)

- A) Adult male
- B) Adult female
- C) Teenager
- D) Elderly woman
- E) Infant

77. (1.00 pts) What is the name of the structure that the green arrow is pointing at? Be as specific as possible.

anterior fontanelle

78. (2.00 pts) Over time, these structures become [a type of joint] through the process of [blank].

sutures

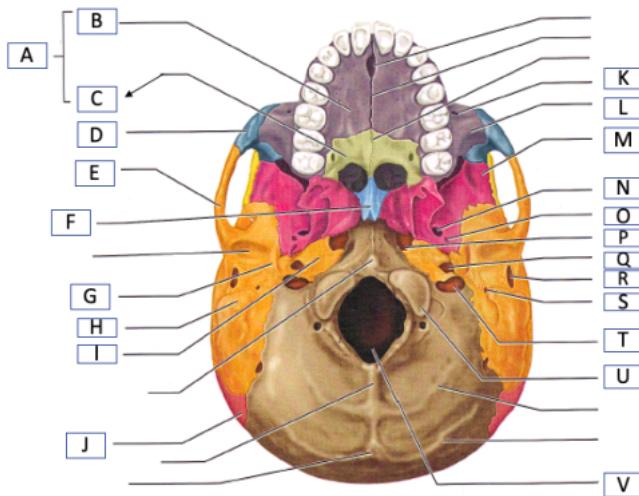
intramembranous ossification

79. (2.00 pts) If this structure is noticeably curved inward, this is known as a [blank] and most commonly indicates [blank].

sunken fontanelle

dehydration

80. (5.50 pts) *Skull Diagram 1*



Label the diagram. Present your answer as:

A:

B:

.

.

C:

D:

.

E:

F:

.

G:

H:

.

I:

J:

K:

L:

M:

N:

O:

P:

Q:

R:

S:

T:

U:

V:

Expected Answer: A: Hard palate B: Maxilla C: Palatine bone D: Zygomatic bone E: Temporal bone F: Vomer G: Styloid process H: Mastoid process I: Temporal bone J: Parietal bone K: Infraorbital foramen L: Maxilla M: Sphenoid bone N: Foramen ovale O: Foramen spinosum P: Foramen lacerum Q: Carotid canal R: External acoustic meatus S: Stylomastoid foramen T: Jugular foramen U: Occipital condyle V: Foramen magnum

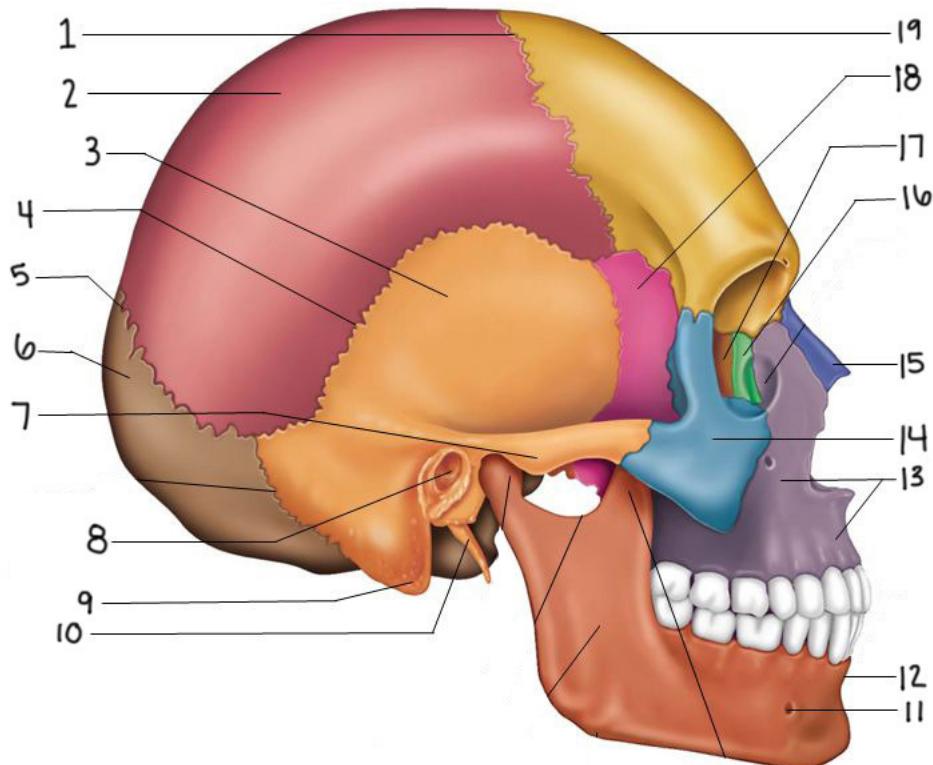
81. (2.00 pts) Structure U articulates with the [three words] of the [blank] to form a [blank] synovial joint.

superior articular facets

atlas

pivot

82. (1.00 pts) *Skull Diagram 2*



(a)

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Which letter on Skull Diagram 1 corresponds to letter 14 on this diagram?

- A) D
 B) E
 C) F
 D) L
 E) M

83. (1.00 pts) Which letter on Skull Diagram 1 corresponds to 13 on Skull Diagram 2?

- A) B
 B) L
 C) M
 D) C
 E) F

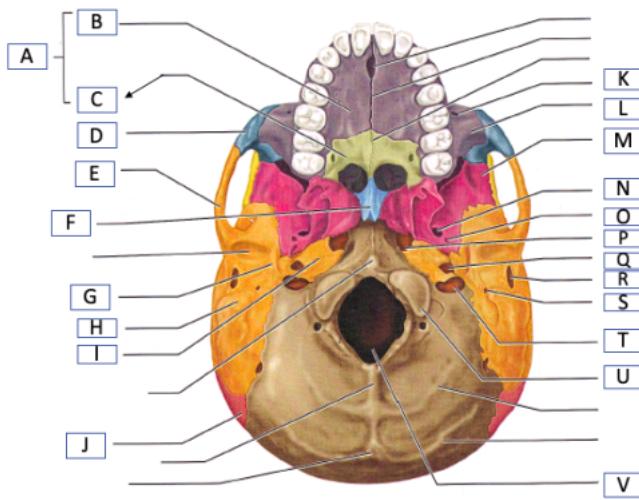
84. (1.00 pts) Label structures 1, 4, and 5.

Coronal suture

Squamous suture

Lambdoid suture

85. (3.00 pts) *Skull Diagram 1 has been provided again for your reference:*



Consider structure M. This structure is known as the [blank] of the skull, and the [blank] of this structure houses the [blank] gland.

keystone

sell a turcica

pituitary

86. (1.00 pts) Through which of the following letters does the spinal cord pass?

- A) N
- B) P
- C) Q
- D) T
- E) V

87. (3.00 pts)

Kaitlyn and Akshay are fighting over what the best Science Olympiad event is, and Kaitlyn made Akshay cry! The [blank] gland secretes tears, and is located in the [blank] cavity. This cavity is made up of [type this number out in letters] bones.

lacrimal

orbital

seven

88. (2.00 pts)

Jake is playing football, and another player ran into him very hard, smashing his elbow into the front of Jake's face, just above his nose. Jake is rushed to the hospital, and he finds that he has largely lost his sense of smell and clear fluid is leaking from his nose. He can hear his doctors fretting about possible meningitis. What bony structure did Jake most likely fracture?

- A) Sella turcica
- B) Cribiform plate
- C) Crista galli
- D) Zygomatic bone
- E) Mastoid process of temporal bone

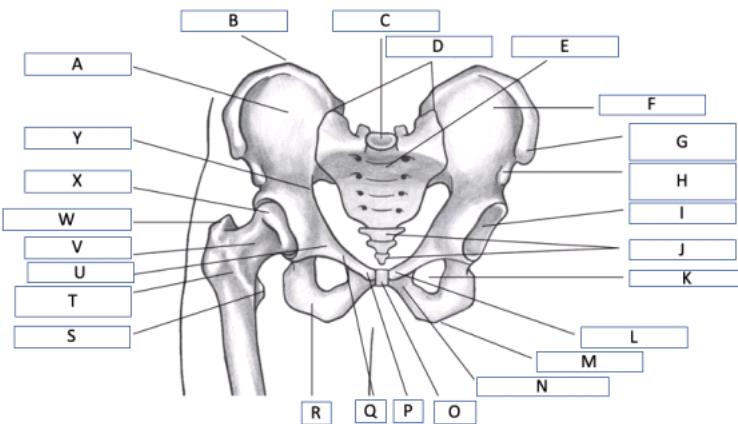
89. (3.00 pts) The structure that Jake fractured forms the roof of the [blank] cavity and houses the [blank]. It is part of the [blank] bone.

nasal olfactory bulb ethmoid

90. (2.00 pts) Knowing this information about the structure Jake fractured, why are Jake's doctors worried about possible meningitis in the brain?

Expected Answer: Because the cribriform plate forms the roof of the nasal cavity, fracture can allow pathogens to pass from the nasal cavity directly to the brain.

Pelvis Diagram



Please label the above diagram.

Tip: Write down the letters and names on a piece of paper and enter them in all at once, otherwise you will have to keep scrolling up to view the diagram. Do NOT label C, U, X, and V.

91. (0.50 pts) A:

 ilium

92. (0.50 pts) B:

 iliac crest

93. (0.50 pts) D:

Plural form needed.

 sacroiliac joints

94. (0.50 pts) E:

 sacrum

95. (0.50 pts) F:

iliac fossa

96. (0.50 pts) G:

anterior superior iliac spine

97. (0.50 pts) H:

anterior inferior iliac spine

98. (0.50 pts) I:

acetabulum

99. (0.50 pts) J:

coccyx

100. (0.50 pts) K:

obturator foramen

101. (0.50 pts) L:

pubis

102. (0.50 pts) M:

ischial tuberosity

103. (0.50 pts) N:

inferior pubic ramus

104. (0.50 pts) O:

pubic symphysis

105. (0.50 pts) P:

public crest

106. (0.50 pts) Q:

superior pubic ramus

107. (0.50 pts) R:

ischium

108. (0.50 pts) S:

two words

lesser trochanter

109. (0.50 pts) T:

intertrochanteric line

110. (0.50 pts) W:

greater trochanter

111. (0.50 pts) Y:

pectenial line

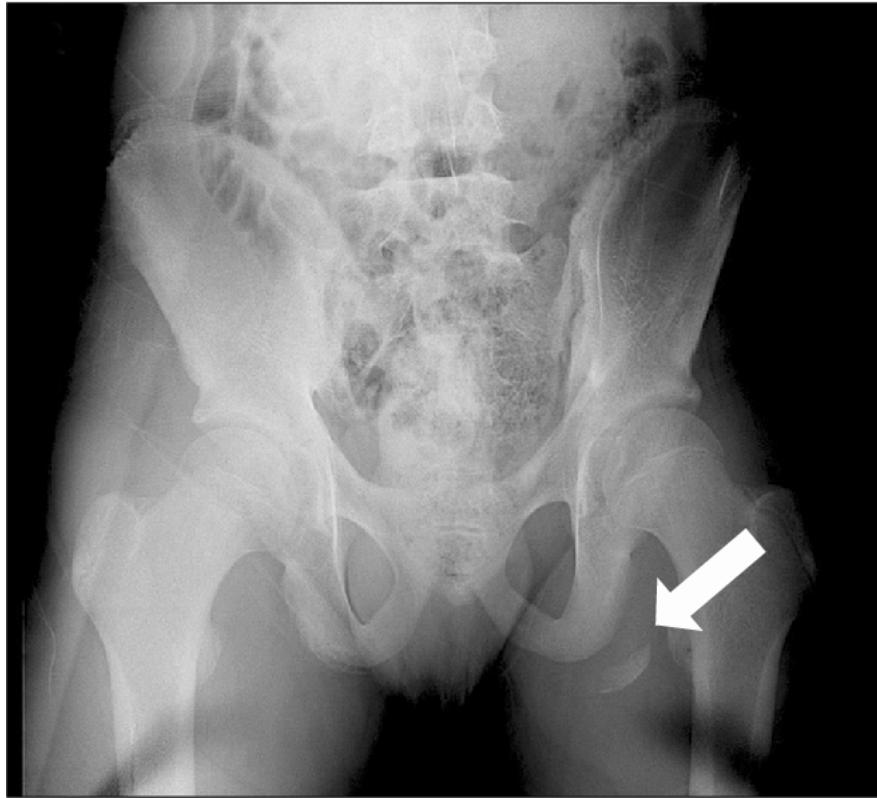
112. (1.00 pts) Is this structure part of the axial or appendicular skeleton?

- A) Axial
- B) Appendicular

113. (1.00 pts) What kind of view of the pelvic girdle is this?

anterior

114. (3.00 pts) Refer to the following radiograph:



What type of fracture occurred, and how does this type of fracture occur?

Expected Answer: Avulsion fracture (2), tendon or ligament pulls off a piece of the bone (1).

115. (2.00 pts) What was the exact site of the injury, and which muscle group did this likely involve?

- A) Ischial tuberosity; hamstrings
- B) Acetabulum; hamstrings
- C) Acetabulum; adductors
- D) Pubic tubercle; adductors
- E) Ischial tuberosity; quadriceps

116. (2.00 pts) Suppose this type of fracture involved the anterior superior iliac spine. Which of the following muscles could have contributed to this fracture?

(Mark **ALL** correct answers)

- A) Gluteus maximus
- B) Sartorius
- C) Tensor fasciae latae
- D) Gracilis
- E) Rectus femoris
- F) Adductor longus

117. (2.00 pts) The female pelvis is known as the [blank] pelvis, as opposed to the [blank] pelvis of the male. Males have a [blank] sacrum than females.

gynaecoid

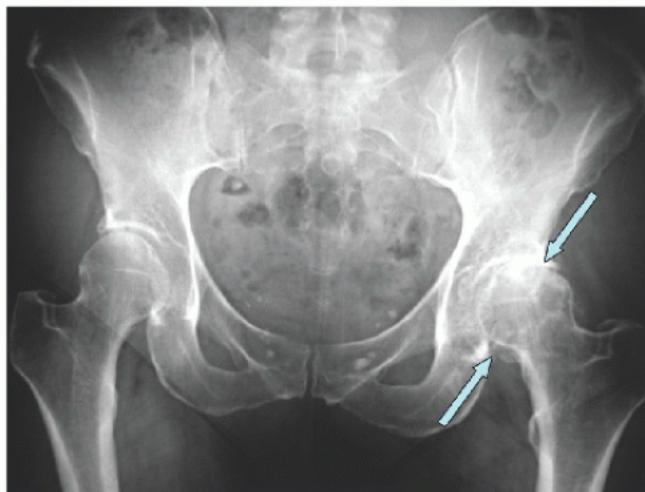
android

longer

118. (3.00 pts)

A 67-year-old male reports left groin pain of gradual onset during the past 6 months that has significantly limited his activities of daily living. He reports walking more than four to five blocks and descending stairs exacerbates the pain.

The following radiograph is of his pelvic girdle:



What pathology is affecting his right hip? Name two pieces of evidence from the radiograph or from the information provided that helped you arrive at this conclusion.

Expected Answer: Osteoarthritis (2); decreased joint space (0.5), sclerosis of acetabulum (0.5), descending stairs and walking exacerbates pain (0.5), other reasonable explanation (0.5). Do not accept left groin pain.

119. (2.00 pts) Select the following statements that are true:

(Mark ALL correct answers)

- A) Thoracic vertebrae are unique in that they possess transverse foramina
- B) Demifacets on the bodies of thoracic vertebrae allow articulation with ribs
- C) L5 does not have an inferior articular facet
- D) Ribs articulate with thoracic vertebrae twice; one on the transverse process and another on the spinous process
- E) Lumbar vertebrae have the largest intervertebral discs
- F) Lumbar vertebrae have heart shaped vertebral bodies

120. (2.00 pts) An intervertebral disc is a [blank] joint. The outer edge of the disc is called the [blank] and is made up of concentric sheets of [blank].

fibrocartilaginous

annulus fibrosus

collagen fibers

121. (2.00 pts) Select the following true statements:

(Mark ALL correct answers)

- A) Intervertebral discs are highly vascular
- B) The annulus fibrosus has the highest concentration of water and proteoglycans in the intervertebral disc
- C) Intervertebral discs resist compression because of their gel-like consistency from proteoglycans
- D) Sciatica is a sign of herniated disc but not spinal stenosis
- E) Intervertebral discs allow no movement

122. (1.00 pts)

Refer to the following MRI scan.

71-year old Neil is super annoyed because he's experiencing muscle weakness and numbness along his left leg paired with an inability to control his bladder. He's a very important man, and it's quite embarrassing when he can't control his bladder in public. He gets an MRI scan of his lumbar vertebrae, and sees this:



What plane was this MRI taken in?

- A) Coronal
- B) Transverse
- C) Sagittal
- D) Axial
- E) Aquarius

123. (4.00 pts)

Based on the information provided and the radiograph, what would you diagnose Neil with? Explain how your diagnosis accounts for Neil's pain, numbness, and inability to control bladder movements.

Expected Answer: Spinal stenosis (2). Spinal stenosis causes pain, numbness, and inability to control bladder movements through compression of the spinal cord (1) caused by narrowing of the spinal canal (1).

124. (1.00 pts) Refer to the following CT scan:



Which vertebrae is fractured?

- A) T11
- B) T12
- C) L1
- D) L2
- E) L3

125. (2.00 pts) What is this kind of fracture commonly known as?

Expected Answer: Chance or flexion-distraction (2).

126. (1.00 pts) Name the three columns of the vertebral body used in classifying a fracture.

Expected Answer: Anterior, middle, posterior. All or nothing.

127. (2.00 pts) Why is it less serious if a fracture affects the spinous process than if a fracture affects the lamina?

Expected Answer: A fracture affecting the spinous process will not have a large effect on the stability of the spinal column because the spinous process is not a central part of the vertebrae and will not cause misalignment issues or nerve damage (1 for either explanation). A fracture affecting the lamina has a high chance of compressing the spinal cord due to proximity and may cause an unstable fracture (1 for either explanation).

128. (1.00 pts) Refer to the following CT scan:



What type of fracture is this? Please enter only one word.

compression

129. (2.00 pts)

If you're told that the patient is a 72 year old woman with hyperparathyroidism, what is the most likely underlying cause of this fracture? The answer is not hyperparathyroidism.

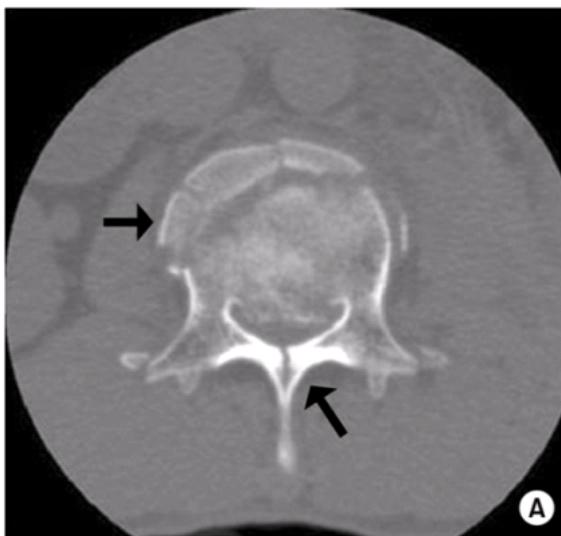
osteoporosis

130. (4.00 pts)

Which two pieces of information provided in the previous question helped you arrive at your conclusion? Explain why the information points to the condition that you identified.

Expected Answer: 1) 71 year old woman (1). She is going through menopause, which increases the risk of osteoporosis due to lack of bone building effects of estrogen (1). 2) Hyperparathyroidism (1). Increased PTH secretion increases rate of breakdown of bone (1).

131. (2.00 pts)



What type of fracture is this?

- A) Burst fracture of thoracic vertebrae
- B) Burst fracture of lumbar vertebrae
- C) Compression fracture of thoracic vertebrae
- D) Compression fracture of lumbar vertebrae
- E) Chance fracture of cervical vertebrae
- F) Compression fracture of cervical vertebrae

132. (1.00 pts)

Last question set for the skeletal system! You're almost there.

Will went for knee surgery last week, and came back home feeling fine. A few days later, he developed a low fever and the area above his knee became red, swollen, and tender to the touch. He went back to the doctor and obtained this image.



Uh-oh. His [left or right] [bone] has a black spot!

right

femur

133. (2.00 pts) Based on the information provided and the radiograph, what could this black spot be indicative of?

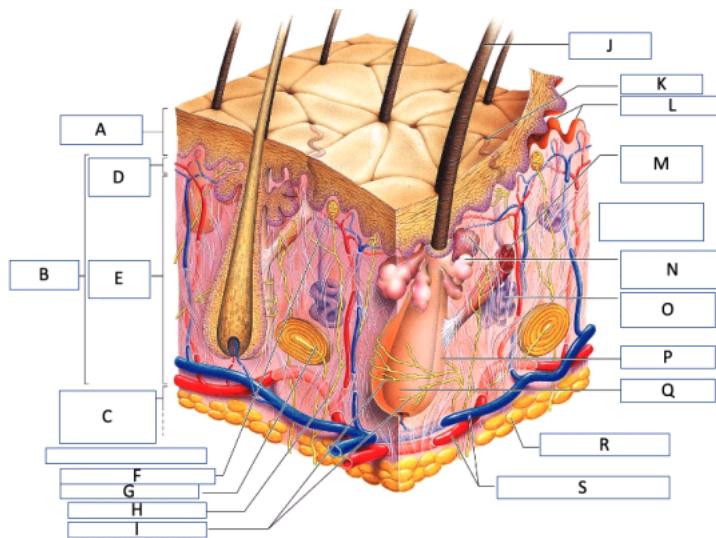
- A) Osteosarcoma
- B) Osteoporosis
- C) Osteomyelitis
- D) Osteogenesis imperfecta
- E) Osteomalacia

134. (3.00 pts) Name 3 common agents of this condition.

Expected Answer: Staphylococcus epidermidis, S. aureus, Pseudomonas aeruginosa, Serratia marcescens and Escherichia coli (1 each)

135. (9.50 pts) Refer to the following diagram:

Label this diagram of the skin:



Expected Answer: A: Epidermis B: Dermis C: Hypodermis D: Papillary dermis E: Reticular dermis F: Meissner's corpuscle G: Pacinian corpuscle H: Sensory nerve fiber I: Hair root plexus J: Hair shaft K: Pore L: Dermal papillae M: Arrector pili N: Sebaceous gland O: Eccrine sweat gland P: Hair follicle Q: Hair root R: Adipose tissue S: Cutaneous plexus/blood vessels (.5 each)

136. (2.00 pts) Which of the following are functions of the structure labeled L?

(Mark ALL correct answers)

- A) Increase diffusion of nutrients across epidermis and dermis
- B) Create fingerprints
- C) Dense sensory region
- D) Harbors many melanocytes; centers of UV ray protection

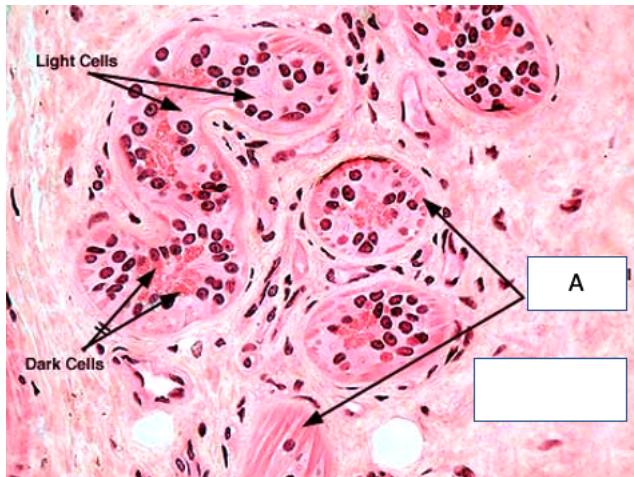
137. (2.00 pts) Which of the following are secreted by eccrine glands?

(Mark ALL correct answers)

- A) NaCl
- B) Fatty acids

- C) Uric acid
- D) Antibodies
- E) Squalene

138. (1.00 pts) Refer to the following diagram.



What structure is this?

Expected Answer: Eccrine sweat gland (1).

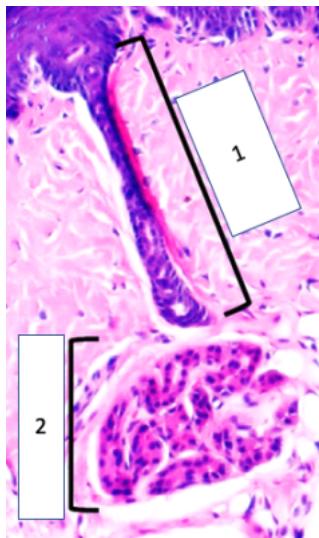
139. (2.00 pts) What type of cells is A referring to, and what is the function of these cells?

Expected Answer: Myoepithelial cells (1), contract to expel secretion of the gland (1).

140. (2.00 pts) What is the function of the light cells? The dark cells?

Expected Answer: Light cells secrete a watery substance similar to blood ultrafiltrate (1) while the dark cells secrete glycoproteins (1).

141. (1.00 pts) Based on the types of cells present here, is this structure 1 or structure 2?



- A) 1
 B) 2

142. (2.00 pts)

Structure 1 is composed of a double layer of [blank] cells. As it passes through the epidermis, it is known as the [blank]. The intradermal part of this gland is [straight or tortuous].

cuboidal acrosyringium straight

143. (1.00 pts) Apocrine sweat glands are more common in glabrous skin.

- True False

144. (2.00 pts) Which of the following are true about apocrine sweat glands?

(Mark ALL correct answers)

- A) They play a role in thermoregulation
- B) They are activated at puberty in response to sex hormones
- C) They play a role in emotional sweating
- D) Ceruminous and mammary glands are types of apocrine glands
- E) They secrete directly onto the skin's surface

145. (3.00 pts) Explain the three types of secretion that sweat glands use.

Expected Answer: Merocrine: Cell secretion by exocytosis, no part of the cell is lost (1) Apocrine: Cell loses part of itself in secretion (1) Holocrine: Cell lyses to secrete product; cell is the secretory product (1)

146. (1.00 pts) Apocrine gland secretions do not have an intrinsically foul odor.

- True False

147. (1.00 pts) Sebaceous glands are:

- A) Simple coiled tubular
- B) Simple branched tubular
- C) Simple branched alveolar
- D) Complex coiled alveolar

148. (3.00 pts) Sebaceous glands and apocrine glands both:

(Mark ALL correct answers)

- A) Use holocrine secretion
- B) Usually secrete into hair follicles
- C) Are located primarily in hairy skin
- D) Are responsible for acne
- E) Have fatty secretions

149. (3.00 pts) Which of the following are functions of sebaceous glands?

(Mark ALL correct answers)

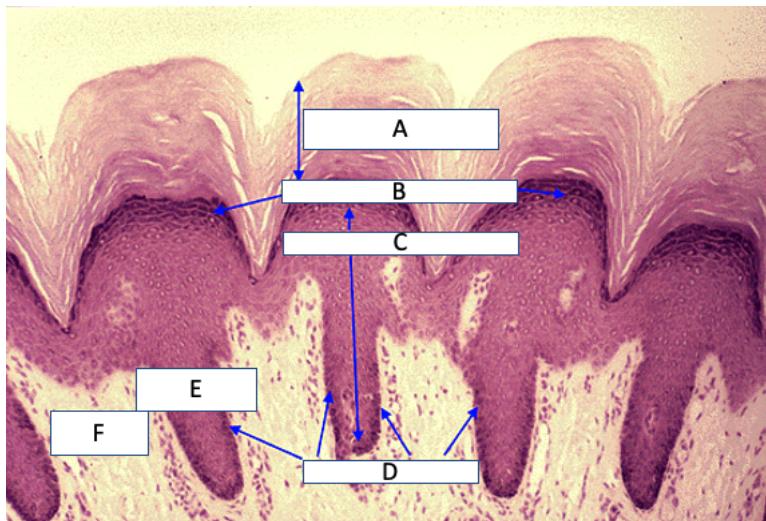
- A) Produce vernix caseosa
- B) Thermoregulation
- C) Lubricate skin and hair
- D) Emotional sweating
- E) Emulsify sweat

150. (1.00 pts) Glands of Zeis, Tyson's glands, and Fordyce spots are all:

- A) Ceruminous glands
- B) Apocrine glands
- C) Eccrine glands
- D) Sebaceous glands
- E) Mammary glands

151. (3.00 pts) Please refer to the following diagram for questions 152-154:

Label:



Expected Answer: A: Stratum corneum B: Stratum granulosum C: Stratum spinosum D: Stratum basale E: Epidermal ridges F: Dermal papillae

152. (1.00 pts) In which letter would you find cells that are actively dividing and moving upwards?

- A) A
- B) B
- C) C
- D) D

153. (2.00 pts) Which layer is absent from this picture? What does this tell you about this region of skin?

Expected Answer: The stratum lucidum is absent (1), so this is thin skin (1).

154. (1.00 pts) You can find hair follicles in this type of skin.

- True
- False

155. (1.00 pts) This type of skin has a higher concentration of Meissner's corpuscles.

- True
- False

156. (1.00 pts) In which layer of the skin would you expect to find melanocytes?

- A) Stratum corneum
- B) Stratum lucidum
- C) Stratum granulosum
- D) Stratum spinosum
- E) Stratum basale

157. (1.00 pts) Melanocytes secrete [blank], which is produced from the amino acid [blank] and protects against [blank; be specific!] radiation.

melanin

tyrosine

UVB

158. (2.00 pts) Select the following true statements. Langerhans cells:

(Mark ALL correct answers)

- A) Come from neural crest stem cells
- B) Are produced in the bone marrow
- C) Are professional antigen presenting cells
- D) Are mostly found in the stratum granulosum
- E) Have Birbeck granules

159. (3.00 pts) The integumentary system offers chemical, biological, and physical protection. Name an example of each type of protection.

Expected Answer: Chemical: Acid mantle, melanin secretion Biological: Macrophages, Langerhans cells Physical: Keratinocyte barrier

160. (2.00 pts)

Jessica is mad because she doesn't think Ashley is eating enough Vitamin C. Ashley argues that she'll just buy a Vitamin C skin cream and apply it to her skin so she can absorb it through her skin. Name two functions of Vitamin C.

Expected Answer: Stimulates osteoblasts, collagen formation, cofactor for Vitamin D (1 each)

161. (3.00 pts) Will applying Vitamin C skin cream be effective? Why or why not?

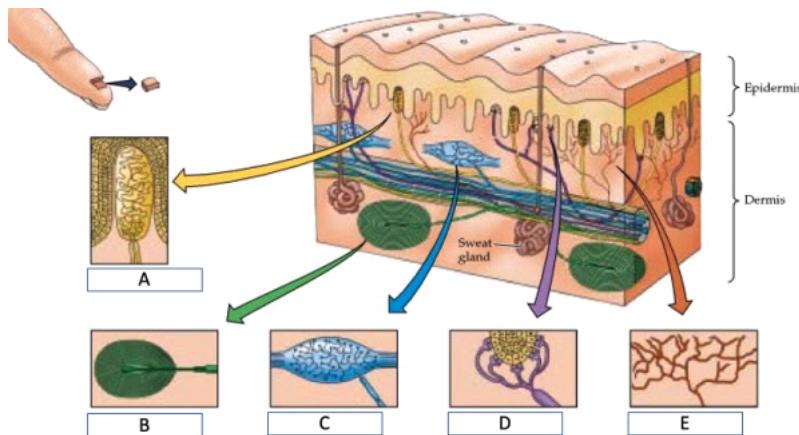
Expected Answer: No (1), because Vitamin C is a water soluble vitamin and cannot pass through the epidermis (2).

162. (2.00 pts) Keratinocytes are attached to the basement membrane by [blank] and to each other by [blank].

hemidesmosomes

desmosomes

163. (2.50 pts) Label the following diagram:



Expected Answer: A: Meissner's corpuscle B: Pacinian corpuscle C: Ruffini's endings D: Merkel's disc E: Free nerve endings (.5 each)

164. (2.00 pts) Structure C senses which of the following:

(Mark ALL correct answers)

- A) Heat
- B) Stretch
- C) Sustained pressure
- D) Light touch
- E) Mechanical deformity

165. (2.00 pts) Which of the structures are tonic receptors?

(Mark ALL correct answers)

- A) A
- B) B
- C) C
- D) D
- E) E

166. (1.00 pts) Which letter allows us to read Braille?

- A) A

- B) B
- C) C
- D) D
- E) E

167. (2.00 pts) Which of the following are changes that occur with age?

(Mark ALL correct answers)

- A) Loss of underlying fat padding
- B) Decrease in Vitamin D synthesis
- C) Loss of collagen
- D) Increase in facial fat
- E) Higher levels of glandular activity

168. (1.00 pts) Where is terminal hair mostly found?

(Mark ALL correct answers)

- A) Scalp
- B) Legs
- C) Armpit
- D) Groin
- E) Arms

169. (1.00 pts) Which type of hair is shed by 36-40 weeks of gestation?

- A) Lanugo
- B) Vellus
- C) Terminal

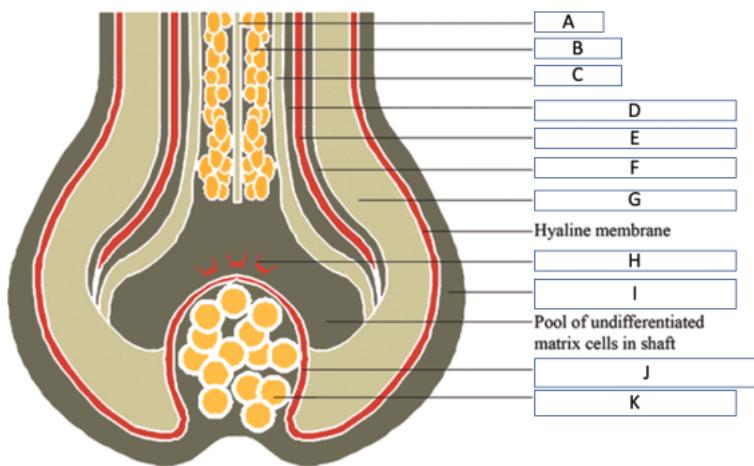
170. (2.00 pts) Which two pigments are responsible for the color of red hair?

(Mark ALL correct answers)

- A) Eumelanin
- B) Pheomelanin
- C) Carotene
- D) Trichosiderin

171. (5.50 pts) Please refer to the following diagram for questions 172-174:

Label:



Expected Answer: A: Medulla B: Cortex C: Cuticle D: Cuticle of inner root sheath E: Huxley's layer F: Henley's layer G: Outer root sheath H: Melanocytes I: Dermal sheath (connective tissue root sheath) J: Basement membrane K: Hair papilla

172. (1.00 pts) Which structure provides nutrients for the hair follicle?

- A) H
- B) J
- C) K
- D) B
- E) C

173. (1.00 pts) Which letter is absent in some hairs?

- A) A
- B) B
- C) C
- D) D
- E) E

Refer to the following images:





D:

An intern was given these pictures of various skin conditions to keep on file, but they lost the labels and now we don't know what skin condition is what! Luckily, you're an integumentary system expert and you can fix this problem. You're told that these skin conditions are four of the following seven conditions:

Shingles, contact dermatitis, inverse psoriasis, scabies infection, urticaria, atopic eczema, guttate psoriasis.

Match the picture to the correct skin condition.

174. (1.00 pts) A:

guttate psoriasis

175. (1.00 pts) B:

shingles

176. (1.00 pts) C:

scabies

177. (1.00 pts) D:

atopic eczema

178. (1.00 pts) What agent is responsible for letter C?

- A) Autoimmune reaction
- B) Parasite

- C) Environmental irritant
- D) Infection with bacterium

Phew, you made it! Congratulations. Please let me know what you thought of the test and email any questions/complaints to **ambermath99@gmail.com** or contact me through Discord **@Silverleaf1#5370**.